

A Review of Solar Wind Ion and Electron Plasma Distribution Functions: Present Understanding and Ulysses Results

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Our present understanding of the distribution functions of the solar wind ion and electron thermal/suprathermal populations will be reviewed, covering selected theoretical and observational topics. Roughly half the review will be devoted to recent discoveries (since Solar Wind 7). Among recent results are those of the Ulysses mission. The SWICS experiment observed pick-up protons and alpha particles, and acceleration of these particles at interplanetary shocks. Positive ion phenomena observed by SWOOPS include enhanced proton-alpha particle differential streaming both: 1) at high latitudes, and 2) in the ecliptic beyond 1 AU in the vicinity of shocks. The SWOOPS positive ion observations also demonstrate relative constancy of the entropy per proton at high latitudes beyond about 2.5 AU. Double beaming in both protons and alphas is observed by SWOOPS on either side of the current sheet, but not within; a possible explanation is reconnection at the edge of the current sheet. SWOOPS observed bi-directional streaming of electrons beyond 2 AU not only within Coronal Mass Ejections, but also upstream of corotating interplanetary shocks. latitudinal and radial gradients of Ulysses electron core and halo temperatures will be discussed, as will work in progress on the three dimensional (in velocity space) properties of ion distributions.

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